# Interlocks

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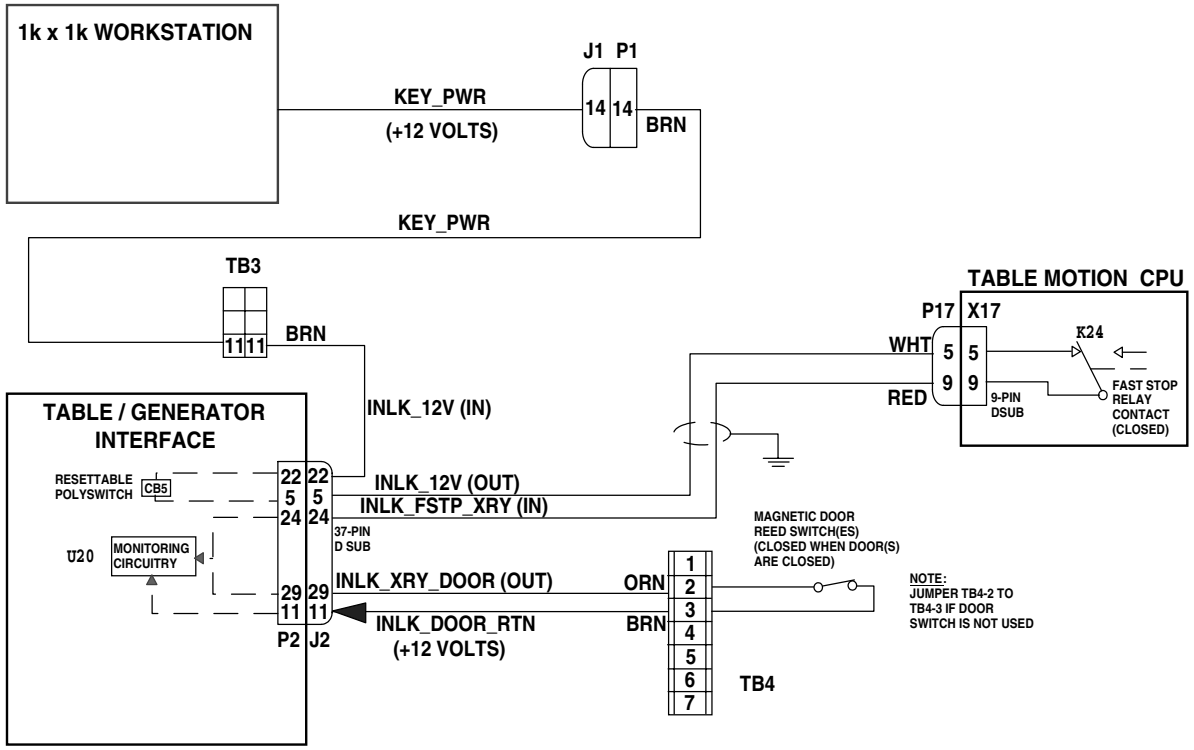
# Circuit/Mechanical Descriptions

The following paragraphs describe the Uroview Subsystem's Interlocks circuitry.

## Introduction

The Uroview 2800 has many software-based and hardware-based safety features that help prevent injury to patients and damage to the equipment. This section discusses the Interlocks circuitry, which is a primary safety feature that prevents X-ray generation when it is unsafe for the patient or unsafe for the equipment to do so.

The following illustration shows the Interlocks circuit currently implemented in the Uroview 2800.




**Uroview 2800 Interlocks Circuitry**

When the OEC WorkStation is powered up, +12 Volts from the Workstation travels through the Lemo extension cable to J1/P1 in the Table. When the +12-Volt signal first enters the Table, it is called KEY_PWR as shown in the diagram. The +12 Volts then travels to TB3 pin 11 for further distribution in the Table.

## Interlocks Circuitry Defined

The word Interlocks refers to a protective series circuit for the +12-Volt Interlocks signal. If this series circuit is broken anywhere, the Generator can't boot or produce X-rays.

## Signal Names

All signals shown in the block diagram are the same +12-Volt Interlocks signal. The block diagram shows how the signal name appears in the Interconnect Diagram (GE OEC Part Number 00-881504) and in other engineering documents.

## Resetable Polyswitch CB5

INLK_12V (IN) enters the Table Generator Interface PCB on P2-22. CB5, a 500 mA resettable polyswitch on the Table/Generator Interface, protects the entire Interlocks circuit from overcurrent conditions. ILK_12V (OUT) (just another name for the +12 Volt Interlocks signal) leaves the Table/Generator Interface on J2 pin 5 and travels through P17 pin 5 to the Fast Stop relay (K24) contacts on the Table Motion CPU PCB.

## Fast Stop Relay Contacts

The Table's Fast Stop circuitry must be in normal condition with neither Fast Stop button pushed in, neither splash and crash switch tripped, and the Fast Stop relay on the Table Motion PCB energized by 24 Volts (contacts closed). Otherwise, the Interlocks circuit is open and the Generator can't boot or generate X-rays.

*Note: There is a Fast Stop button on the X-ray Control Console, and another one on the front of the Table near the film cassette. If the Generator won't boot, check these two buttons first.*

## Monitoring Circuitry

The Interlocks signal from the Fast Stop Relay contacts to the Table Generator Interface is called INLK_FSTP_XRY (IN). This signal travels straight through the Table/Generator Interface, leaving this PCB as INLK_XRY_DOOR (OUT) on J2 pin 29. Monitoring circuitry in the Table/Generator Interface checks the Interlocks signal at several points, and reports an error condition

when +12 Volts is not present at any monitored point. Any such error prevents the Generator from booting or working, and immediately interrupts any X-rays in progress.

## Optional Room Door Switch

The Interlocks signal from the Table/Generator Interface to TB4 is called INLK_XRY_DOOR (OUT). TB4 is a terminal block located on the back of the Electronics Slide Assembly that permits the connection of a normally closed magnetic room door switch or similar protective device into the Interlocks circuit. If there is no door switch, make sure to jumper TB4-2 to TB4-3.

The final leg of the Interlocks circuit is INLK_ DOOR_RTN, which connects from pin 3 of TB4 to P2-11 on the Table/Generator interface. Monitoring circuitry on the Table/Generator interface monitors the Interlocks signal at this point and disables the Generator when the Interlocks signal is not present.

## Door Interlock and X-ray In Use Light

The Uroview 2800 system has provisions to add door interlocks and lighted signs that will coordinate with the X-ray system. These provisions provide a safer environment for both patient and radiologist. The door interlock prevents X-rays until the primary barriers are closed, for example a door. A sign will illuminate when X-rays are generated, warning personnel that X-rays are in use.

***Note:*** *Door switch interlock must be completely wired through a normally open contact for the system to operate.*

### *WARNING: Risk of electric shock.*

The following electrical components are required to wire the door interlock and light fixtures:

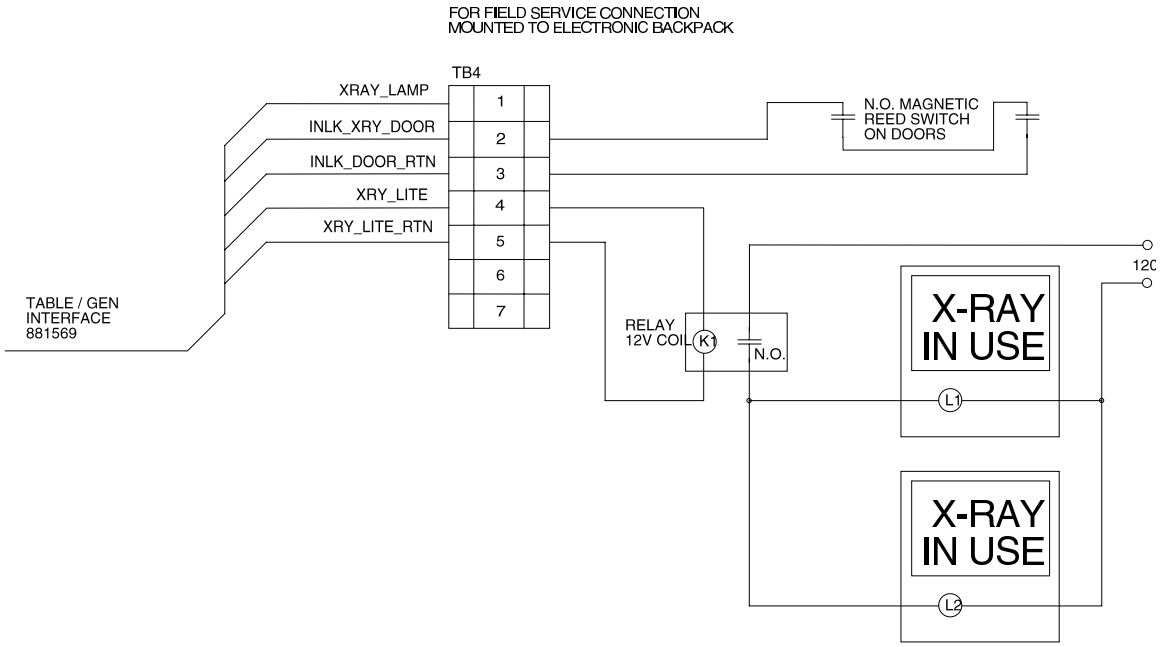
- Normally open magnetic reed switch for each door. 20VDC, 0.5A, with screw terminals.
- Relay to interface light fixture. 12VDC coil, SPDT contact rated 10A at 240VAC. One relay for each system.
- Interface wiring to coil and switch contacts shall be insulated 18 AWG copper wire.

**Typical light fixture**

The following illustration provides an example of how to wire a room with two doors. The illustration shows:

- 2 Normally Open Magnetic Reed Switches
- 2 X-ray in Use Lights
- 1 Relay
- 120 VAC utility
- Wiring of the lights, reed switches and relay to TB4

***WARNING: 120 VAC should not be wired to any terminal on TB4. Connecting 120 VAC to TB4 will result in severe damage to the Table Generator Interface (TGI) PCB. Use a relay with a 12 VDC coil for isolation purposes.***

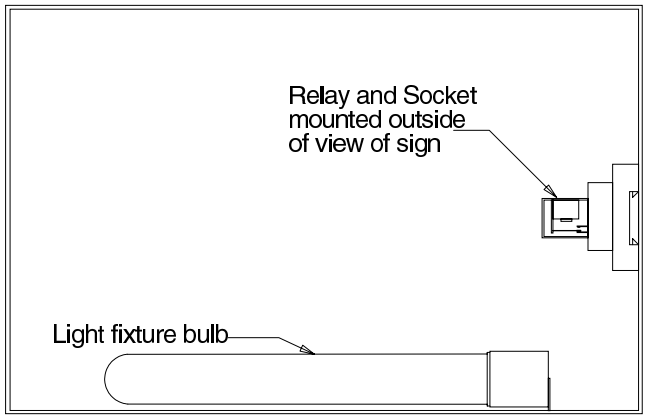



**Room Architecture Interface Wiring Example**

The interface for the room architecture is located on Terminal Block TB4. TB4 is located inside the tower, on the lower third portion of the electronic backpack. The terminal block has seven terminals. The following table describes each terminal on TB4.

| Terminal | Signal Name | Description |
|---|---|---|
| TB4-1 | (XRY_LAMP | This terminal is a current sink through a field effect transistor (FET) that is grounded. This terminal is not normally used, and reserved for GE OEC Medical Systems. |
| TB4-2<br>TB4-3 | INLK_XRY_DOOR<br>INLK_DOOR_RTN | These two terminals are for the door interlock switches. These terminals form a loop with normally open switches wired in series at each door that is to be protected. When the circuit detects an open switch along the string of switches the system will prevent the creation of X-rays until all switches are closed. This circuit is best implemented by using a normally open magnetic reed switch on each door. The reed switch is located in the upper corner of the door opposite the hinges, and the magnet is located on the door opposite the reed switch. When the door is closed the magnet will be in close proximity to the reed switch and closes the contacts in the switch. |
| TB4-4<br>TB4-5 | XRY_LITE<br>XRY_LITE_RTN | These two terminals are for the “X-ray in use” light fixture. Terminal four will source a 12 volt DC voltage to a relay coil that will insolate the rooms 120 volts AC wiring for the lighted signs from the systems electronics. The terminal marked five is ground for the 12 volt DC source on terminal four and will connect to the relays coil. |
| TB4-6<br>TB4-7 | N/A | Not used |

The relay may be incorporated into the “X-ray in use” light fixture. See diagram below.




**Example of Relay and Pilot Light incorporated into a light fixture**

## Summary

The Interlocks circuitry checks for the following conditions, all of which must be present for the system to boot completely and be capable of generating X-rays:

- The OEC WorkStation must be powered up and plugged into the Table/Generator subsystem.
- Resettable polyswitch CB5 on the Table/Generator PCB must be closed to provide +12 Volts to the Interlocks circuitry.
- The Fast Stop circuitry must not be tripped or damaged.
- TB4 pins 2 and 3 must be connected to a closed room door switch or be jumpered together. If these pins are connected to one or more door switches in a series loop, these doors must all be closed to provide continuity between pins 2 and 3.

# Functional Tests

## Interlocks Test

The following test verifies proper operation of the system Interlocks:

1. Turn on the system and allow it to boot completely.
2. Verify that the system can take a normal fluoroscopic X-ray.
3. Push the FAST STOP button on the X-ray Control Console.
4. Verify that the system can no longer produce X-rays.
5. Verify that the message FAST STOP ACTIVATED – UNLOCK THE BUTTON TO CONTINUE appears on the X-ray Control Console's VFD and on the Collimator Housing's VFD.
6. Release the FAST STOP button you pressed in step 3 and verify that the system can again make X-rays.

# Fault Isolation

| Problem | Possible Cause | Action |
|---|---|---|
| Fast Stop button doesn't disable X-rays. | Fast Stop relay contacts stuck shut | Check Fast Stop Relay on Table Motion CPU. Replace PCB if necessary. |
| | Fast Stop Button defective. | Check continuity on both Fast Stop buttons. Buttons are normally closed. |
| No message appears when you press a Fast Stop button | Defective VFD | If only one VFD is bad, check power and data to suspect VFD. If both power and data are present, replace non-functional VFD. |
| | No input to VFD | Troubleshoot Communications line to VFD. Refer to Communications chapter for details. |
| | No power to VFD | Troubleshoot appropriate DC power supply. Refer to Power Distribution chapter for details. |

# Adjustments

Not applicable

# Miscellaneous

Not applicable.